Statement of C. Paul Robinson, Director
Sandia National Laboratories

United States House of Representatives
Committee on Armed Services
Military Procurement Subcommittee

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INTRODUCTION

Mr. Chairman and distinguished members of the committee, thank you for the opportunity to submit this statement for the record of the hearing today. I am Paul Robinson, director of Sandia National Laboratories. Sandia is managed and operated for the U.S. Department of Energy (DOE) by Sandia Corporation, a subsidiary of the Lockheed Martin Corporation.

Sandia National Laboratories is a multiprogram laboratory of DOE and is one of the three National Nuclear Security Administration (NNSA) laboratories with research and development responsibility for nuclear weapons. Sandia's job is the design, development, qualification, and certification of nearly all of the non-nuclear subsystems of nuclear weapons. Our responsibilities include arming, fuzing, and firing systems; safety, security, and use-control systems; engineering support for production and dismantlement of nuclear weapons; and surveillance and support of weapons in stockpile. We perform substantial work in programs closely related to nuclear weapons, including intelligence, nonproliferation, and treaty verification technologies. As a multiprogram national laboratory, Sandia also performs research and development for DOE's energy and science offices, as well as work for other national security agencies when our special capabilities can make significant contributions.

I will begin my statement with a discussion of my general concerns regarding the budget submission for fiscal year 2002. I will then present an overview of three major planned investments that are necessary for advancing Sandia's capability to support programmatic deliverables in the future. Following that, I will discuss in detail Sandia's responsibilities in NNSA's Stockpile Stewardship and Nonproliferation missions. I will also comment on the proposed NNSA realignment.

CONCERNS OVER THE FISCAL YEAR 2002 BUDGET

During the last several months, the Defense Programs laboratories have worked closely with the NNSA to construct a future-years requirements profile for the nuclear security program. The funding levels of the multi-year estimates in that plan reflected our consensus estimate of stockpile stewardship requirements under the guidance then available as defined by Presidential directives and Department of Defense (DoD) requirements. The President's budget for NNSA Defense Programs released on April 9 was $863 million less than what we had estimated would be required in fiscal year 2002 to meet the requirements of that program plan ($6.163 billion).

I understand, of course, that the National Defense Review, the Quadrennial Defense Review, and the Nuclear Posture Review, are still in progress. The results of those studies may cause changes in defense policy that could affect the nation's nuclear security program one way or another. Pending new guidance that may result from those reviews, we will have to consider how to adjust current program requirements to the budget resources provided.

Against that backdrop, it is also clear—as the Foster Panel testified to Congress—that the infrastructure of our nation's nuclear weapons complex has eroded significantly over the last two decades. In addition, significant changes will be required to weapons systems that may remain in the stockpile for several decades. Consider just two examples of emerging design and production needs: Life extension activities for the W76 and the W80 will require significant resources—people, facilities, and materials. In addition, the annual production target for neutron generators has more than doubled, from 600 to 1,500 units, and will require additional capacity and staff. These and other evolving stockpile requirements will demand their share of resources from a program that is already "wound too tight."

From a Sandia perspective, the current proposed budget for the NNSA would necessitate a deferral or curtailment of several infrastructure activities required for the NNSA complex of the future, with some delays in deliverables for directed stockpile work. The key unfunded or under-funded budget priorities from the Sandia point of view are described in four priority groupings:

1. Our highest priority items are maintaining the current schedule of life-extension programs for both the W80 and the W76 warhead systems and the construction of the Microsystems and Engineering Sciences Application (MESA) complex at Sandia National Laboratories.
2. The next group of priority items involves the construction of two facilities to support NNSA's Accelerated Strategic Computing Initiative (ASCI): the Distributed Information Systems Laboratory (DISL) and the Joint Computational Engineering Laboratory (JCEL).
3. The third budget priority item is the refurbishment of NNSA's Z Accelerator at Sandia.
4. Fourth, there are several other key investments that are needed to maintain our support for the stockpile, such as the construction of the Weapons Evaluation and Testing Laboratory (WETL), cyber-security enhancements, neutron generator production, and other facilities and infrastructure projects.

I will discuss these facilities and activities and their importance to the stockpile stewardship program in this statement. Significant changes to these activities and projects may be required to accomplish the mission objectives of the NNSA. It will be critical for the NNSA to strike a proper balance among the various program elements at its laboratories to establish the right priorities and schedule resources in a way that meets stockpile deliverables while allowing for prudent investments in capabilities.

MAJOR CAPABILITY INITIATIVES

Sandia continues to plan for and invest in capabilities to meet the anticipated mission requirements of the NNSA. Three key initiatives are especially important for supporting the programmatic needs of the Stockpile Stewardship Program and are at the forefront of our investment planning.

Microsystems and Engineering Sciences Application (MESA) Complex

Sandia's Microsystems and Engineering Sciences Application (MESA) complex is the cornerstone of our initiative to address the need for microelectronics and integrated microsystems to support a certifiable stockpile for the future. Advances in computation and microtechnologies during the past several years will be applied to stockpile modernization in MESA. MESA will provide essential facilities and equipment to enable teams of weapon component designers, subsystem designers, computational analysts, and microsystems specialists to design, integrate, and qualify components and subsystems for nuclear weapon system assemblies

Microelectronic components are critical to the NNSA Defense Programs mission. Such components largely determine the reliability of weapon systems, the precision of weapon function at the target, and the operability of weapons in the severe environments encountered during delivery. Several key components in deployed nuclear weapons will need to be replaced within the decade. In most cases, components cannot be replaced with replicas of the originals because they are technologically obsolete and the supplier base, materials, and design tools to support them no longer exist. Moreover, competent designers would not elect to use decades-old electronic technology, even if it were available. Because of space and weight constraints in all stockpiled weapon systems, Sandia has little choice but to meet component replacement needs using new microsystem technologies.

In addition, Sandia has an obligation to preserve critical capabilities in radiation-hardened microelectronics for defense and space hardware, including those satellite systems that monitor international arms control treaties. In 1998 Congress mandated that Sandia retain the institutional memory for radiation-hardening technology and sustain a supporting infrastructure for developing radiation-hardened microelectronics. MESA will provide the required infrastructure to meet that mandate for future decades. MESA is a major system project with a total estimated construction cost of $374 million. The construction start for MESA was deferred in fiscal year 2001, and it appears that construction may again be deferred in fiscal year 2002.

Facilities Supporting NNSA's Accelerated Strategic Computing Initiative

Sandia plays a major role in NNSA's Accelerated Strategic Computing Initiative (ASCI), also known as the Defense Applications and Modeling Campaign. ASCI is developing the advances in computational science that will enable the shift from test-based methods to computational methods for stockpile assessment and qualification.

Sandia will support ASCI with construction of two key facilities at its major laboratory sites: The Distributed Information Systems Laboratory (DISL) at Sandia's site in California will develop distributed information systems required to enable collaborative design and manufacturing across the nuclear weapons complex utilizing ASCI-scale tools. The Joint Computational Engineering Laboratory (JCEL) at Sandia's site in New Mexico will be a state-of-the-art facility for research, development, and application of multi-physics code development on massively parallel computer platforms.

Under a tri-laboratory agreement, allocations for JCEL and DISL have been deferred in past fiscal years. Unless additional funds are provided, it appears that construction starts for JCEL and DISL may again have to be deferred in fiscal year 2002.

Z Accelerator Refurbishment

NNSA's Z Accelerator at Sandia National Laboratories provides critical experimental data for the Stockpile Stewardship Program. Z produces over fifty times the x-ray energy and a factor of five more x-ray power than any existing, non-explosively driven, laboratory facility, making it the closest approximation to the conditions created in nuclear explosions. It is a major resource for ensuring the safety, security, and reliability of the nation's stockpile. Yet, Sandia faces an unfunded need to refurbish Z to extend its lifetime and improve its performance, reliability, and shot rate.

In May 2000 an independent review committee chaired by Dr. Richard Garwin (Fellow Emeritus of IBM's Thomas J. Watson Research Center and a recipient of DOE's Fermi Award) and composed of experts from the nuclear weapons laboratories, DoD, academia, and industry overwhelmingly endorsed both the programs and the refurbishment of Z: "The Committee was unanimous in its belief that an incremental, cost-effective upgrade of Z . . . is worth pursuing."

The refurbishment will produce higher quality experimental data from increased precision and reproducibility at even higher energies than the world-record levels that have already been attained by Z alone. It will also support significantly more experiments per year.

Refurbishment of this national asset could be completed in three years at the comparatively modest cost of $60 million for design, procurement, and fabrication of hardware and equipment. The initial capital investment of $10 million to begin this refurbishment in fiscal year 2002 is not in the budget request. An increase of $10 million in operating funds in fiscal year 2002 would also permit us to begin the ramp-up of operational capabilities to conduct double-shift operations to meet the demand for experiments. NNSA, DoD, and Sandia's partners at Lawrence Livermore and Los Alamos national laboratories will benefit from this investment. Specifically, the refurbished Z Accelerator will provide the following benefits to the NNSA Stockpile Stewardship Program:

- Accurate material property data at higher pressures for weapon-relevant materials for four of the Stockpile Stewardship Program campaigns: Dynamic Materials Properties, Advanced Simulation and Computing, Secondary Certification, and Inertial Confinement Fusion.
- An enhanced environment to evaluate radiation flow for the Secondary Certification Campaign.
- More energetic radiation sources to test non-nuclear components for the Nuclear Survivability Campaign.
- Insight and confidence in scaling parameters to a next-generation facility for the Inertial Confinement Fusion Campaign.

We believe that coupling an ultra-high-power laser to the refurbished Z would add significant capability for the stockpile stewardship program at modest additional cost. A collaborative effort between Sandia and several other laboratories funded with an additional $5 million in fiscal year 2002 would be useful for examining the scientific utility and technical feasibility of this combination.

The requirement to maintain a pulsed power capability over the interim during which the National Ignition Facility is constructed is paramount to our ability to fully support a stockpile stewardship program. It is important not to lose sight of the extraordinary capability of the Z Accelerator and its significance to the stockpile stewardship program.

STOCKPILE STEWARDSHIP ACTIVITIES

Stockpile stewardship activities include directed stockpile work, campaigns to advance the scientific and engineering capabilities required for weapons stockpile qualification and certification, and readiness programs for the NNSA's technology base and facilities. A major effort of the stockpile stewardship program is directed to the annual certification process for assessing nuclear weapons in the stockpile. As a result of work during the past year by Sandia's technical experts and their colleagues at the other NNSA laboratories, I am able to report that the U.S. nuclear weapons stockpile today is safe and reliable. I recently affirmed this technical judgment—with respect to the nuclear weapon components and subsystems that are Sandia's responsibility—in my annual certification letter to the secretaries of Energy and Defense, who in turn certify the stockpile to the President. As part of the assessment process, the laboratories conduct reliability and safety investigations and prepare a report for each weapon type in the stockpile. We at Sandia National Laboratories see no need to conduct an underground nuclear test at this time to validate our assessment.

Directed Stockpile Work

Directed Stockpile Work encompasses all activities that directly support specific weapons in the nuclear stockpile. These activities include current maintenance and day-to-day care as well as planned refurbishments. Additionally, this work includes research, development, engineering, and qualification activities in direct support of each weapon type both in the present and future. Directed stockpile work maintains a balanced effort of near-term weapon activities and long-term research and development supported in campaigns.

Stockpile Research and Development

Stockpile Research and Development includes the exploratory and engineering research and development necessary to support near and long-term requirements of the nuclear weapons stockpile. This activity includes development of new weapon designs when needed and authorized; preproduction design and engineering activities; design and development of weapon modifications; and safety studies and assessments. Sandia's efforts focus on the continuing application of tools and hardware to be used to further our mission responsibilities in stockpile assessment and certification, maintenance, surveillance, and refurbishment in accordance with the schedule, as well as general supporting research and development.

Specific focal areas anticipated for the next two fiscal years include support for refurbishment of several existing stockpile systems; system studies and surety assessments; development and qualification of specific components and subsystems; development of improved and modernized engineering business practices and information systems; development of improved flight test assemblies and instrumentation; and exploration of potential future system concepts.

Engineering Development

The bulk of the engineering development planned in stockpile research and development will support the life extension refurbishments of the B61, W80, and W76. The objective of the stockpile life extension effort is to improve and extend the safety and reliability of U.S. nuclear weapons twenty to thirty years by upgrading or replacing components and subsystems rather than entire warheads. That challenge requires detailed, integrated planning for design, development, and production throughout the nuclear weapons complex. Sandia has been identified by NNSA to be the systems integrator for refurbishments.

To upgrade or replace degraded components and subsystems within budget, on schedule, and with near-zero defects, Sandia is making the most of existing facilities by improving its own business, engineering, and manufacturing processes. With NNSA and its production agencies, we are identifying future life extension options and scheduling them to plan level workloads and avoid fluctuations in labor costs. We have adopted DoD's approach of "Cost As an Independent Variable" and are defining DoD and DOE requirements up-front, rather than negotiating trade-offs between design options and cost later. We have baselined design and production of the W88 arming, fuzing, and firing (AF&F) system and used that data to commit to cost targets for replacing the W76 AF&F system. Where possible, we buy commercial off-the-shelf parts. When no commercial equivalents exist, we design and build custom parts. Computational simulations, balanced with developmental nonnuclear tests, are minimizing design iterations, thereby reducing the time and cost to qualify new components. Consistent with efficient, effective commercial manufacturing, we are moving toward process-based quality techniques and are improving our quality monitoring and acceptance processes.

Sandia is acutely aware of cost as a principal concern, and we are working diligently to keep costs to a reasonable minimum. But as a laboratory director who signs the final weapon development report for systems when they are first delivered to DoD and annually reports on the safety and reliability of the stockpile to the secretaries of Energy and Defense, I cannot allow cost to over-constrain design and development activities and potentially compromise mission success. Ultimately, our goal is the cost-effective safety, security, and reliability of the nation's nuclear defense.

We are helping NNSA and DoD implement the new "Phase 6.x process" for producing and maintaining weapons in the stockpile. This is the formal process by which we plan and authorize the effort to extend the life of an existing nuclear weapon system. (It should not be confused with DoD's phase 6 numbering system for its cycle of research and development.)

Sandia is involved with two Phase 6.3 refurbishment designs, and we are in Phase 6.2 with a third system. The W76/Mk 4 (Trident I) entered Phase 6.3 formal refurbishment design engineering last year with a first production date of fiscal year 2007. The W80 warhead for Air Force and

Navy cruise missiles also entered Phase 6.3 for refurbishment with scheduled first production in 2006. We are also engaged in a Phase 6.2/2A study for the refurbishment of the B61 strategic bomb, with first production scheduled for fiscal year 2004. These refurbishments will replace critical components to ensure decades of life extension. At the same time, they will upgrade the component technologies to ensure maintainability and cost efficiency while enhancing safety and reliability.

As part of the W87 life extension program, Sandia enhanced the structure of non-nuclear components in the warhead and requalified existing components, extending the warhead's service life for at least another twenty years. This work required us to reproduce a number of components that were used during flight testing in order to ensure adequate hardware for the extended years.

Beginning in 1996, Sandia worked with DoD to convert a set of B61-7 gravity bombs into B61-11 earth penetrators. Early tests revealed a design issue. We used computer simulations developed under the Defense Applications and Modeling Campaign to understand the issue and perform a redesign, which was performed with fewer, more useful experiments at less cost than in the past. In August, 2000, we presented the design and qualification results to the DoD Design Review and Acceptance Group. We expect final Nuclear Weapon Council Standing and Safety Committee acceptance soon.

We are developing the new B61-3/4/10 Realistic Weapon Trainer for use in Europe, with first delivery expected in October. These new trainers look identical to the war reserve bombs, and they incorporate features that simulate all the safety and use-control attributes of actual bombs. The new trainers will replace older units and allow personnel to improve their proficiency in moving, handling, loading, and electrically interfacing with weapons. By reducing the need to access actual war reserve bombs for training, the Realistic Weapon Trainer will also improve the safety and security of European-based U.S. nuclear weapons.

Sandia is developing a code management system that will employ modern, National Security Agency-approved, encrypted code control features, which will also be delivered to the European Command and U.S. Air Force in Europe beginning in October. This new system will replace older equipment that can no longer be maintained with modern, man-portable equipment that will make the transfer of codes to the field more secure and error-free. The equipment will become standard for the U.S. Strategic Command, U.S. Air Force depots, the NNSA Pantex plant, and other entities.

As these examples show, Sandia is alert to short-term and long-term needs of the stockpile, makes good use of NNSA's investments in stockpile stewardship technologies, and is a vigilant steward of the nation's nuclear weapons stockpile.

Exploratory Research and Development

One particular concern I want to bring to your attention today is the current state of health of exploratory research and development within the nuclear weapons program at all three laboratories. I recently had the opportunity to review the state of health of these efforts, and I was deeply disturbed at what I found. There is little fundamental thinking and exploration of new concepts that could fundamentally change and improve the nation's defense posture, nor are there efforts focused on avoiding technological surprise by adversaries of the United States. Such efforts appear to have been the victims of the extensive budget cutting over the past decade.

You in the Congress are certainly aware of the crucial and historical role that advanced science and technology have played in keeping the United States preeminent in defense and national security. I believe that our scientific leadership has itself been a major part of our deterrent against conflicts, large and small; therefore I am greatly troubled by the present sorry state of this work. In the past, the existence of efforts to explore newly created technology to seek future advantage for the United States has been a critical factor in attracting and keeping the best scientists and engineers in defense work. Each generation is driven to make its own contributions to America's strength and, by doing so, to help ensure a more peaceful world. Restoring the exploratory research and development effort is vital to everyone's interests, and I urge your support to correct the present situation.

Stockpile Maintenance

Sandia's efforts in stockpile maintenance include production design and actual production of some of the components needed in system life extension operations and repairs associated with life extension programs, limited-life component exchange, and development and engineering activities that directly support the maintenance of the stockpile. For each weapon in the existing inventory, attention must be paid to understanding and resolving defects (called "significant findings"), maintaining use-control equipment, and replacing hardware needed for the surveillance function. Because the service lives of many nuclear weapons have been extended well beyond their original intent, we are exhausting the supply of surveillance units. More surveillance units must be produced, but the instrumentation to measure performance in joint flight tests with DoD must be redesigned using the electronics technology available today.

Sandia has the production mission for neutron generators, an essential component. Sandia manages two pieces within its production mission: (1) Neutron generator production, including both the recertification of neutron generators from the field that have remaining service life and the new neutron generator build; and (2) the Manufacturing Development Engineering (MDE) production assignment. As neutron generator production ramps up and the MDE program grows to support the W76 and W80 life extension programs, production operating funds will require an increase over fiscal year 2001 of approximately $50 million by fiscal year 2005. (Estimates are still being generated since the refurbishment programs are currently defining the MDE components they will need.) Unfortunately, no clear methodology exists within the nuclear weapons complex today for assessing new production requirements and their priorities relative to existing requirements.

Neutron Generator Production

In 1994, DOE forecasted that 600 neutron generators per year would be sufficient to support the active stockpile. When the Defense Programs' neutron generator production facility in Pinellas, Florida, closed in 1994, Sandia built its production facility to meet that requirement. (Sandia-manufactured neutron generators first entered the inventory in August 1999.) In 1997, DOE revised the requirement to 1,550 neutron generators per year by fiscal year 2004 to support both the active and inactive stockpiles. That new requirement exceeded Sandia's capacity. To meet the increased demand, Sandia is reconfiguring its facility through the Rapid Reactivation Project during fiscal years 1999 through 2002. To meet this schedule, Sandia is buying materials and hiring and training additional production operators. Changes to the DOE Directive Schedule now require a level loaded production capacity of 1,350 neutron generators per year with the final ramp up to full production by fiscal year 2008.

Manufacturing Development Engineering (MDE) Production

Sandia's MDE production assignment includes critical components in microelectronics, power sources, and magnetics, with high complexity in design and manufacture that are not available commercially as off-the-shelf items. Approximately 50 MDE-procured components per year are required to support the stockpile. These components are to support limited life component exchange, the surveillance program, and refurbishments.

As system life extension programs shift into production, the MDE program will support delivery of components for each weapon as it undergoes refurbishment. It is projected that by fiscal year 2005, in preparation for the W80 and W76 life extension programs, MDE workload costs will increase almost threefold. For fiscal year 2002, Sandia requires an increase over the planned appropriation of $4.9 million.

Stockpile Evaluation

Stockpile evaluation includes laboratory tests, flight tests, quality evaluations, special testing, and surveillance of weapon systems to assess the safety and reliability of the nuclear weapon stockpile as a basis for the annual certification to the President.

Surveillance testing frequently results in recommendations for repairs and upgrades to the stockpile. Last year, following Sandia procedures, DoD replaced limited-life components in several weapon systems to add what we believe will be significant periods of maintenance-free service while the weapons are in DoD custody.

The surveillance program remains a key tool in our planning process for system improvements in the Stockpile Life Extension programs. NNSA and Sandia are aggressively looking for new means of improving our capabilities. From June to December of last year, Sandia participated in the NNSA-wide strategic review of the surveillance program that will put NNSA and Sandia on a course toward improving our surveillance capabilities in the twenty-first century. We use the Enhanced Surveillance Program as the research and development source for new technologies and diagnostics that will give our surveillance evaluation techniques greater predictive capability.

Our aging surveillance infrastructure is being replaced. Congress approved a construction line item that will replace a forty-year-old facility, the Weapons Evaluation Testing Laboratory, at NNSA's Pantex Plant. This new construction will provide a state-of-the-art facility for testing weapon components and implementing advanced diagnostic techniques developed by the Enhanced Surveillance Campaign. We are separately working to design and build new system test equipment that will both update our aging equipment and incorporate further enhancements from the Enhanced Surveillance Program. Both of these projects are important for maintaining confidence in the safety, reliability, and performance of the stockpile without nuclear testing.

Last year Sandia introduced new, non-destructive, acoustic laboratory testing of stronglinks, a major safety component in our warheads, into the core surveillance program. This year we have added a second development from our Enhanced Surveillance Program into this core surveillance test gear that will allow us to evaluate the electrical current carrying potential of these safety devices. Both of these new tests have allowed us to better predict the useful lifetime of this critical component and enhance our replacement planning strategy.

To evaluate weapons in the active stockpile, Sandia annually conducts between seven and nine laboratory tests on each type of weapon and between two and four flight tests of each type of weapon. On average, eleven weapons per system are sampled. Tests that identify deviations from requirements lead to thorough investigations that may, in turn, result in repairs and retrofits or in recommendations for stockpile improvement programs.

Let me highlight one area of general concern: DoD and DOE annually conduct joint flight tests on weapons of each weapon type. Historically, flight tests have uncovered about 22 percent of the defects recorded in surveillance databases. Budgetary constraints and other issues can inhibit DOE laboratory and military service support of the joint DOE/DoD Stockpile Surveillance Program. For example, the possibility of shortfalls to Air Force ICBM strategic missile testing could impact reliability assessments of the Minuteman III W62 and W78 warheads and the Peacekeeper W87 warheads. In addition, implementation of the terms of the START-II treaty will change reentry configurations from multiple to single vehicles while holding the number of missile test flights each year constant, thus reducing both the number of warheads that can be flown on each test and the opportunities to gather data on reliability and possible problems.

A second example is the Air Force support of cruise missile testing. Their infrastructure has aged to the point where they may not be able to support any cruise missile testing in fiscal year 2002 while they procure and train on new equipment. Both the Navy and the Air Force are also concerned about their ability to support the number of flight tests that we believe we need for developmental testing in the life-extension program for the W80, as well as its subsequent regular surveillance flight-test requirements. We are working with the military services to address these important long-term issues related to flight testing.

To help compensate for shortfalls in flight tests and a dramatic reduction in the number and variety of reentry vehicles that can be flown if the W87 is deployed on Minuteman III, on-board instruments must be improved to provide additional performance information in fewer tests. This past year, we successfully flight tested an enhanced-fidelity instrumentation package in the W87 reentry vehicle.

The surveillance program is the foundation for maintaining the aging stockpile. We believe the surveillance program should maintain an adequate number of flight tests each year using military personnel, procedures, and hardware. Therefore, I urge you to assure an appropriate level of support for the joint surveillance flight test program, for both DOE and the DoD, to sustain confidence in the reliability of our strategic nuclear deterrent.

Dismantlement and Disposal

Sandia performs analysis and technology development to support dismantlement and safe storage of weapons being removed from the stockpile. Dismantlement and disposal includes activities associated with weapon retirement, disassembly, component characterization, and disposal or reclamation of materials and components; the engineering, development, testing, qualification, certification, procurement, and refurbishment of containers required for interim storage; and the staging and storage of weapons, components, and materials awaiting dismantlement. Sandia's efforts focus on tools and processes for safe disassembly, staging and storage, and component processing and characterization.

Field Engineering, Training, and Manuals

As the U.S. nuclear ordnance engineering center, Sandia has unique responsibilities for training DoD personnel who handle nuclear weapons, including explosive ordnance disposal teams.

Training covers the proper handling, storage, maintenance, and potential use of the nuclear deterrent. Our efforts in these areas focus on military liaison and support to the field, training, and maintenance of weapon manuals and reference materials.

Stockpile Stewardship Science and Technology Campaigns

Campaigns are multifunctional efforts across the NNSA Defense Programs laboratories, the production plants, and the Nevada Test Site that, in aggregate, constitute an integrated weapons science and technology program for developing critical capabilities for weapons qualification and certification. The goal of the Defense Programs campaigns is to address current or future issues by employing the best scientists and engineers and using the most advanced sciences and technologies. Many of the campaigns are interrelated and establish a foundation for future deliverables in directed stockpile work. Without a robust campaign program, our ability to support stockpile stewardship would be seriously harmed.

Sandia makes significant contributions in twelve of the seventeen Defense Programs campaigns. I will discuss Sandia's contributions to several of them.

Dynamic Materials Properties

This campaign includes efforts to develop experimentally validated data and models of all stockpile materials under a broad range of dynamic conditions found in nuclear explosions. In the past, dynamic material properties were often inferred from test data on a descriptive and empirical basis. Without the availability of nuclear tests, the materials models developed by this campaign are essential for establishing predictive relationships between material properties and stockpile performance, safety, and reliability.

Secondary Certification and Nuclear Systems Margins

Sandia's efforts in this campaign will improve the theoretic and computational capabilities and support the development of computational models required to predict the performance of nominal, aged, and rebuilt secondaries and thus help certify the stockpile in the absence of nuclear testing. A specific Sandia activity in this campaign is the development and characterization of radiation environments that are required for the campaign's major technical efforts.

Inertial Confinement Fusion Ignition and High Yield

This campaign pursues high-yield target designs on pulsed power systems. Sandia's efforts in this area will validate the baseline for a high-yield capsule design and will use the Z Accelerator to support other campaigns and nuclear weapon program priorities.

Certification in Hostile Environments

This campaign develops certification tools and microelectronic technologies required in the absence of nuclear testing to ensure that refurbished weapons meet the stockpile-to-target sequence requirements for hostile environments. Sandia's involvement in this campaign consists both of work on radiation-hardened electronics and other non-nuclear components and on experimentally validated computational tools to design and certify them. This campaign is vital to the life extension programs for the W76 and W80 and other systems to be refurbished in the future.

Advanced Simulation and Modeling

To achieve simulations with the complexity and fidelity required to support stockpile stewardship, NNSA must increase its computational capability tremendously. The Accelerated Strategic Computing Initiative (ASCI), mentioned earlier, will hasten advances in computational science to enable the shift from test-based methods to computation-based methods.

ASCI campaign activities at Sandia consist of work in applications, problem solving environments, maintenance of sufficient on-site computational networking and communication capabilities, and alliances with academic research germane to ASCI goals. We are working on new mathematical methods, algorithms, and software for the solution of large-scale problems on massively parallel, often distributed systems. Areas of importance include shock physics, engineering mechanics, chemically reacting flows, electromagnetics, and the computational analysis and design of materials—all with application to accident scenarios, weapons performance and safety, materials aging, and manufacturing. As these techniques are developed, they are incorporated directly into codes and applications relevant to nuclear weapon systems design and certification, weapon system response prediction, weapon life spans, and virtual prototyping for the requalification and replacement of components and subsystems.

Confidence in our computational modeling capabilities depends on continuing close integration with our abovegorund experimental programs, which permit both the direct testing of weapon components and the validation of computer models. We remain confident that the combination of experimental data and advanced modeling and simulation will provide us with a solid foundation on which to base our assessments of nuclear weapons.

Weapon System Engineering Certification

Supporting both certification and directed stockpile work, the Weapon System Engineering Certification Campaign develops science-based engineering methods to increase certification confidence through validated simulation models and high-fidelity experimental test data. We develop validated engineering computational models and tools that directly support certification of the B61, W76, and W80 stockpile life extension programs.

Enhanced Surety

Over the past fifty years, Sandia has played a key role in designing and improving the safety, security, and reliability—the surety—of our nuclear weapons stockpile. As stewards of the stockpile, we identify deficiencies, assess security and use-control using probabilistic risk techniques, and take into account increased international and domestic terrorist threats. As a result of these efforts, we believe improvements can and should be made to the security of the warheads. Knowing the surety of the stockpile in detail, including its day-to-day status, gives us higher confidence and indicates where significant long-term improvements are warranted.

In past years, DOE and DoD have continuously improved stockpile surety. Early improvements like permissive action links (weapon security locks), encryption, active protection, insensitive high explosives, and enhanced nuclear detonation safety architectures entered the stockpile as improvements to warheads. Operations also improved, for example, as DoD introduced weapon storage vaults, coded control, safe transport, and enhanced procedures—all of which Sandia developed.

Over the last decade, stockpile surety has improved, but primarily as a consequence of the retirement of older warheads (such as the B53 and W69) that did not incorporate modern surety features and through selected surety upgrades. Improvements to stockpile surety had leveled off during the 1990s. However, NNSA's plans for life extension programs will offer rare opportunities to improve surety significantly.

Enhanced Surveillance

The Enhanced Surveillance Campaign develops tools, techniques, and models to measure, qualify, calculate, and predict the effects of aging on weapon materials and components and to understand how those effects impact weapon safety and reliability. Weapon surveillance will be augmented with new diagnostics for early detection of potential defects. The campaign will provide valuable information for long-term capability development, such as when new manufacturing facilities (e.g., pit production) will be needed. Enhanced surveillance techniques will protect the credibility of the deterrent by warning of manufacturing and aging defects in time to schedule weapon refurbishment before performance is impaired.

Advanced Design and Production Technologies

The Advanced Design and Production Technologies (ADAPT) campaign provides technology maturation and integration of modern product realization tools and methods across NNSA's product realization enterprise, including both the laboratories and plants. One element of the program is presently focused on deploying integrated planning tools across the complex that will support load-leveling and program optimization. ADAPT also supports the complex-wide integration of model-based engineering and manufacturing tools, standards, and concurrent engineering methods that represent commercial best practices. ADAPT continues to support many of the special process development activities mentioned earlier—power sources, magnetics, and electronics—that are essential to the refurbishment programs.

Budget challenges within the weapons programs have historically been amplified for such engineering infrastructural elements. Given the anticipated stockpile refurbishment workloads for the next twenty years, the W76–1 and W80 programs must and do provide the requirements focus to drive modernization of our full product realization processes.

Readiness in Technical Base and Facilities

Readiness in Technical Base and Facilities provides infrastructure and operational readiness at NNSA facilities.

Facilities and Infrastructure Revitalization Initiative

Like other sites across the NNSA complex, Sandia has a number of aging facilities in need of refurbishment that fall below the level of line-item construction and are insufficiently supported by general plant projects (GPP) or other infrastructure funding programs. Infrastructure problems at this level are chronically understated and deferred, and they accumulate with the passage of years. Ultimately, this can lead to capability limitations that impair the mission.

NNSA recognized that this problem must be addressed, rather than be allowed to worsen. NNSA's Facilities and Infrastructure Revitalization Initiative is an effort to inventory and prioritize unaddressed infrastructure repair and improvement projects across the complex. The initiative was intended to support an appropriation request of $300 million in fiscal year 2002 to help bridge the gap for essential infrastructure repairs that are unfunded. The multi-year effort would require a continuous infusion of funds on the order of $400 – $600 million annually for the following five years.

We identified approximately $300 million in items at Sandia National Laboratories that would be carried out under the Facilities and Infrastructure Revitalization Initiative during the course of the next few years. We submitted a list of thirty candidate projects for a recent inventory conducted by NNSA that can be effectively addressed in fiscal year 2002. The aggregate estimated cost of those items is $114 million. These projects would normally be funded through standard infrastructure programs such as GPP, maintenance, capital equipment, decontamination and demolition, and infrastructure planning—areas that were perennially deferred for lack of sufficient funding. Some of these items were aggregated with line-item projects in the past, but because construction line items are subject to long lead times, such projects have often been delayed.

Top priority items on our inventory for NNSA's Facilities and Infrastructure Revitalization Initiative are sufficiently urgent that failure to fund them soon will impact weapon program deliverables. For example, qualification of weapon components for the W76, B61, and W88 could be affected by failure to address these top revitalization priorities in a timely manner.

Another priority item for the Facilities and Infrastructure Revitalization Initiative is Sandia's Electromagnetic Test Facility. The existing facility is deteriorating; its twenty-year-old diagnostic equipment has limited capability to support data acquisition for the development and validation of simulation codes. This modernization project will improve our capability to perform electromagnetic tests to qualify the W76 and W80 in accordance with their life extension plans.

NNSA's Facilities and Infrastructure Revitalization Initiative will perform a very important service to the Defense Programs mission if it succeeds in restoring the appropriate balance in funding for infrastructure improvements that are critical to sustaining mission capabilities. A carefully constructed revitalization initiative will help Sandia and the rest of the Defense Programs complex deal with longstanding infrastructure challenges. We must also have a more viable decontamination and demolition program to dispose of obsolete facilities. We must make a stronger commitment to major renovations and deferred maintenance, and we must actively use General Plant Projects to maintain and revitalize our sites. Typically, much of this work is deferred to the out-years, usually with no guarantee that adequate funding will be available then. It is essential that additional infrastructure revitalization funding be made available if we are to maintain the nuclear weapon laboratories at the level of capability necessary to support the Stockpile Stewardship Program.

NONPROLIFERATION ACTIVITIES

Sandia's support for the NNSA Office of Defense Nuclear Nonproliferation includes research and development for a variety of systems for detecting proliferation of weapons of mass destruction, verifying international agreements, enhancing the protection of nuclear material and nuclear weapons in Russia, eliminating inventories of surplus fissile materials useable for nuclear weapons in Russia, and providing mechanisms to enhance regional stability.

I am quite concerned that the fiscal year 2002 budget proposes substantial cuts in NNSA's programs for nonproliferation and verification research and development and arms control. I know there is some concern about whether these programs are truly effective in promoting U.S. nonproliferation objectives. However, I believe an analysis of the laboratories' contributions to nonproliferation technology will argue strongly for maintaining strong support for them.

Nonproliferation and Verification Research and Development

Sandia is developing a new generation of satellite-based sensors for detecting low-yield nuclear explosions in the atmosphere. We also are developing data processing technology to enhance seismic detection of underground nuclear explosions. Our activities are part of a multilaboratory program to develop affordable, deployable, and flexible sensors for seismic, hydro-acoustic, radionuclide, and infrasound data acquisition and processing. These activities are being coordinated and, in many cases, co-funded by DoD, which has the operational nuclear test monitoring responsibility within the U.S. government.

We are also developing airborne and satellite-based systems for detecting and characterizing proliferation-related activities involving chemical weapons, biological weapons, and missiles. Sandia coordinated the integration of NNSA's Multispectral Thermal Imager Satellite research project, which has recently completed its first year of successful operation and research. With other national laboratories, we are developing laser-based techniques for remote detection and identification of chemical species in effluent plumes. We have made impressive progress in developing specialized chemical microsensors, bioinformation systems, and decontamination technologies for nuclear, biological, and chemical weapons and for detecting nuclear material smuggling.

Sandia has significantly advanced the state of the art in synthetic aperture radar systems for national security applications that require all-weather, day-and-night capabilities in real time. We have recently transferred that technology to industry for incorporation into DoD's unmanned aerial reconnaissance vehicles.

Arms Control

Based on our experience in engineering nuclear weapons, Sandia assists with the evaluation of export licenses for technology with possible application for weaponization activities. We also help develop technology for International Atomic Energy Agency remote monitoring and inspections.

NNSA's Cooperative Monitoring Center at Sandia National Laboratories assists a number of countries and agencies in evaluating the applicability of arms control technologies and procedures for regional security issues. Prototype monitoring equipment allows representatives of regional parties (from areas such as south Asia, the Middle East, the Balkans, and the Korean peninsula) to perform hands-on evaluation of various products and technologies and use models to simulate the application of technical solutions to specific regional problems. The Cooperative Monitoring Center supports technical analysis of policy options for DOE and provides national security insight to other organizations. We also provide technical advice to U.S. negotiating delegations.

Sandia has been an active participant in the International Proliferation Prevention Program, which engages weapons scientists, engineers, and technicians from the former Soviet Union in nonmilitary projects. The Proliferation Prevention Program furnishes seed money for research and provides links with U.S. industry to commercialize the new activities.

In a particularly effective case, an engineer from Sandia worked with counterparts at the Russian nuclear weapons laboratory Chelyabinsk-70 to create a capability for designing foot and knee prostheses for landmine victims. The program attracted the assistance of a U.S. prosthetics manufacturer which defined the requirements for parts and performed final laboratory and clinical testing. The Russian engineers designed a titanium housing, and Sandia robotics engineers designed the knee's internal workings and electronics. The program provided employment opportunities in an area of civilian need for Russian technical personnel.

International Materials Protection, Control, and Accounting

Since 1993, Sandia has participated in the multilaboratory Materials Protection, Control, and Accounting Program to reduce the threat of nuclear materials proliferation from the former Soviet Union. This program, which originally included projects in Russia and a number of the newly independent states, now focuses on Russia in the areas of nuclear materials and nuclear facilities operated by the Ministry of Atomic Energy, the Ministry of Defense, and smaller independent ministries. Activities include training, hardware installations, and maintenance.

Highly Enriched Uranium Transparency Program

In February 1993, the United States and Russia signed an agreement to convert highly enriched uranium from dismantled Russian nuclear weapons into low-enriched uranium for fuel to be used in commercial nuclear reactors. The United States agreed to purchase 500 tons of highly enriched uranium for use in the nation's reactors after conversion to low-enriched uranium fuel. The agreement also established measures to fulfill nonproliferation, physical security, material accounting and control, and environmental requirements for highly enriched uranium and low-enriched uranium. The Highly Enriched Uranium Transparency Program is intended to develop confidence that certain U.S./Russian nonproliferation objectives are being met—i.e., that highly enriched uranium from Russian nuclear weapons is blended into low-enriched uranium, shipped to the United States, and fabricated into commercial reactor fuel.

Sandia provides technical, administrative, and management support for the program in several areas, including on-site monitoring, data authentication and tamper indication for special monitoring equipment, vulnerability assessments, and advanced technology development to support the transparency regime.

COMMENTS ON NNSA REALIGNMENT

Under the leadership of General John A. Gordon, NNSA has made significant progress during the past year toward establishing its own identity as a semi-autonomous agency. I am very pleased that General Gordon solicited inputs from the laboratory directors when he was considering structural alternatives for the NNSA. The lab directors spent a fair amount of time discussing with him how their organizations work and exploring other successful models of enterprise management and organization.

On March 14, General Gordon announced his decision for realigning the NNSA structure. The organizational arrangement selected by General Gordon is both a common corporate model and one that is successfully employed at the laboratories. I am hopeful that the new structure, when fully staffed with qualified managers, will help NNSA elements work more effectively as a team supporting the agency's mission.

NNSA Headquarters Realignment

The most significant change at the headquarters level is the creation of two associate administrator positions, one for facilities and operations and the other for management and administration. These posts will provide the infrastructural and administrative support for NNSA missions.

The practice of high-level support organizations furnishing services to lines of business is common in industry. Teamwork and a strong sense of commitment are required for the success of this arrangement. In the NNSA, the associate administrators will understand that it is their job to support and facilitate the missions of the enterprise. The new NNSA headquarters organization is essentially a teamwork structure involving all the associates and deputies in the job of accomplishing the mission. I believe General Gordon's organizational changes can permit a strong executive team to take root at NNSA headquarters and provide clear and unambiguous leadership without the bureaucratic infighting and empire-building that all too often afflict government agencies.

Key to the success of the new NNSA headquarters organizational structure is the realization that all members of the executive team have a duty to support the line managers who are responsible for overall program performance. All positions in the top organizational structure must regard the program managers not only as subordinates whom they direct, but also as customers whom they serve.

An analogy can perhaps be drawn with how the U.S. military conducts operations. Command elements don't just issue commands: they also actively support the soldiers and commanders in the field. All command organizations—whether they be operations, logistics, maintenance, or supply—are focused on supporting the combat organizations. Infighting at the command level would be counterproductive to that effort. It is essential that all elements of an executive or command structure function as a team supporting first-line operations.

Unfortunately, these positive attributes of effective command or executive management were not always present in the former DOE organization because of confusion of authority and responsibility among various offices and levels across the extensive DOE structure. I am very hopeful that the congressionally mandated autonomy of the NNSA and the new headquarters organizational structure established by General Gordon will replace the former confusion and counterproductivity with clear lines of authority and a strong sense of teamwork.

NNSA Field Organizations Realignment

The second phase of General Gordon's realignment plan will consider the realignment of field office roles and responsibilities. General Gordon has tasked a team to make recommendations for this second phase, and he indicated that he will make decisions on their recommendations in July.

There are those who argue that the NNSA field offices are no longer needed and that their functions should be moved to headquarters. I believe that point of view is uninformed about the complexity and magnitude of the tasks performed by the field offices. Mission management and constructive oversight require close ties with those doing the work. This fact argues for placement of the mission offices in the field in order to have decisions made as close as possible to the areas where those decisions have effect. The direct administration of the nuclear weapons program (including functions such as contract administration; site management; environment, safety, and health; quality assurance; and product acceptance) should be left to the NNSA's field elements.

Decentralized management of research and development (R&D) is widely practiced in industry. These days, a corporate office would be very unlikely to pull R&D management up to the corporate level and away from the business units. On the other hand, business units are accountable to the corporate office for the results of their R&D activities. The analogy for NNSA is to think of the NNSA Albuquerque Operations Office as the business unit responsible for the stockpile, and NNSA headquarters as the corporate office. Responsibility for day-to-day operation of the weapons production complex should be performed from a single field office, rather than from Washington.

The decentralized structure of the DOE operations offices is a proven concept, but there is room for improvement. Rather than moving day-to-day management of the weapons program to NNSA headquarters, we should devote attention to streamlining the field management system. NNSA nuclear weapons work should report to a single field operations office. Oversight activities should be coordinated between the field and headquarters to avoid burdensome duplication. In general, the Albuquerque Operations Office oversees stockpile production, maintenance, and dismantlement while headquarters deals directly with the laboratories for research initiatives. The field office adjusts the production and maintenance-related pieces of this complex, and the laboratories themselves adjust the research and development support for stockpile stewardship. This flexibility has been especially important when it was necessary for the laboratories to respond to urgent stockpile problems or to plan for future stockpile requirements.

I hope and expect that the upcoming realignment of NNSA field organizations will clarify the appropriate roles of both headquarters and the field offices with respect to their functions and relationships with the laboratories. If the realignment eliminates redundant and confusing lines of authority in oversight and program management, both among various field offices and between the field and headquarters, then it will accomplish a very useful purpose.

Subsequent attention then needs to be paid to achieving the best governance structure possible between the federal responsibilities and those assigned to the contractor organizations. There has been considerable confusion growing over the past two decades as to how the roles and responsibilities should be assigned within the unique government-owned, contractor-operated partnership that comprises the nuclear weapons complex. Rather than the characteristic jockeying for power that has too often characterized the DOE system, it is important to regain a “systems view” with every organization understanding its role and where it fits into the whole. I am confident that John Gordon will seek changes that are both effective and workable.

CONCLUSION

I am very concerned that the proposed fiscal year 2002 budget for the NNSA will result in deferral or curtailment of several important infrastructure projects and program deliverables. Depending on what new policy guidance may result from the defense reviews currently underway, NNSA and the laboratories may have to reconsider how to adjust current program requirements to the budget resources provided.

I believe the NNSA has made significant progress during the past year. The agency is beginning to function with more coordination and teamwork, attributes that will surely be strengthened even more as the Administrator’s realignment proposal is implemented. Success of the NNSA is not assured, however. The agency needs strong support from Congress and adequate resources to meet the formidable requirements of stockpile stewardship in the decades ahead.